Clean Water Advisory Group

Effluent Dominated Streams

February 28, 2006

Department of Natural Resources
Water Protection Program
Water Pollution Control Branch

Effluent Dominated Vs. Effluent Dependent

Need to determine which of the following is of interest:

- An effluent dominated stream that contains more effluent than receiving water (> 50% effluent)
- An effluent dependent stream that is 100% effluent and would cease flow if anthropogenic sources were to stop discharging.
- Existing rules at 10 CSR 20-7.031 allow for both discharge scenarios

Mixing Zones

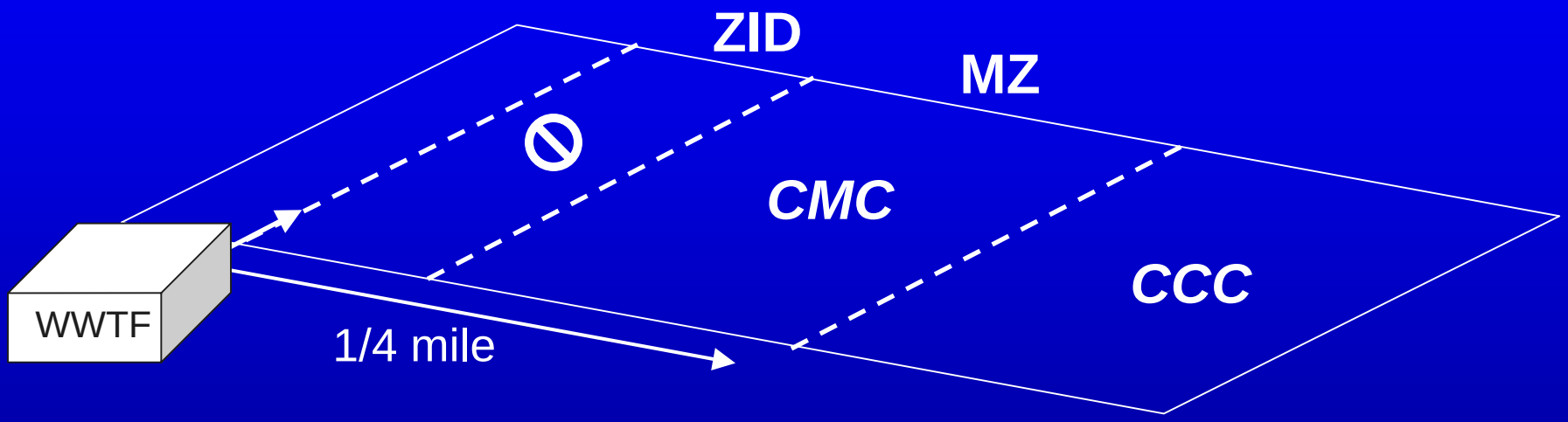
Mixing zones are areas of limited size near a facility outfall where numeric water quality criteria may be exceeded.

- General Criteria found in 10 CSR 20-7.031(3) must be met
- Zones of passage must be provided to avoid lethality to passing organisms
- Limited in size (volume, area, length) so that designated beneficial uses and aquatic communities are not adversely impacted

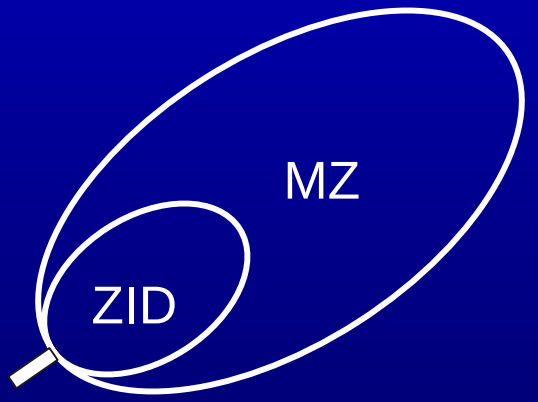
Numeric Water Quality Criteria

- Chronic Criteria
  - CCC = Criteria Continuous Concentration
  - Apply to classified waters only
  - Apply at the edge of the mixing zone
  - Effects evident after 4 days of exposure
- Acute Criteria
  - CMC = Criteria Maximum Concentration
  - Apply to classified and unclassified waters
  - Apply at the edge of the zone of initial dilution
  - Apply at all times in unclassified waters
  - Effects evident after 1 hour of exposure

Regulatory Mixing Zones



MZ = Mixing Zone
ZID = Zone of Initial Dilution
CCC = Criteria Continuous Concentration
CMC = Criteria Maximum Concentration



Regulatory Mixing Zones

- Unclassified streams
  - No mixing zone or ZID
  - Acute criteria must be met end-of-pipe
  - Chronic criteria must be met at the confluence with classified water
- Class C and streams with 7Q10 < 0.1 cfs
  - Mixing zone not allowed
  - Zone of initial dilution not allowed
  - chronic criteria must be met end-of-pipe

10 CSR 20-7.031(4)(A)4.B.(I)

Regulatory Mixing Zones

- Streams with 7Q10 flow 0.1 - 20 cfs
  - Mixing zone one-quarter (1/4) stream width, cross-sectional area, or volume of flow; length one-quarter (1/4) mile
  - Up to one-half (1/2) stream width, cross-sectional area, or volume of flow if rapid and complete mixing is suspected
  - ZID one-tenth (0.1) of the mixing zone width, cross-sectional area, or volume of flow

10 CSR 20-7.031(4)(A)4.B.(II)

Regulatory Mixing Zones

- Streams with 7Q10 flow > 20 cfs
  - Mixing zone one-quarter (1/4) stream width, cross-sectional area, or volume of flow; length one-quarter (1/4) mile
  - ZID one-tenth (0.1) of the mixing zone width, cross-sectional area, or volume of flow and no more than ten (10) times the effluent design flow volume unless the use of diffusers or specific mixing zone studies can justify more dilution
  - Modeling often needed to delineate

10 CSR 20-7.031(4)(A)4.B.(III)

Regulatory Mixing Zones

- Lakes and Reservoirs
  - Mixing zone not to exceed one-quarter (1/4) of the lake width at the discharge point or one-hundred feet (100') from the discharge point, whichever is less.
  - Obtain mixing zone volume using length = width and average depth of zone at low pool (l x w x d)
  - Zone of initial dilution not allowed; acute criteria must be met end-of-pipe

10 CSR 20-7.031(4)(A)4.B.(IV)

Effluent Dominated Vs. Effluent Dependent

Narrow the focus of the discussion to the discharge scenario of interest -

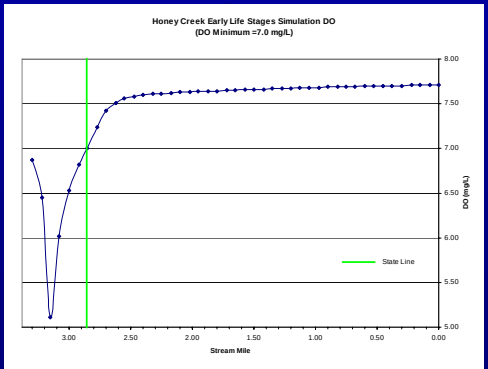
- An effluent dependent stream that is 100% effluent and would cease flow if anthropogenic sources were to stop discharging.
- Are protections against acute toxicity sufficient for an effluent dependent stream containing aquatic life?
- Are protections against chronic toxicity more appropriate for these discharge conditions?

Discussion

Chronic Criteria for Total Ammonia: General Warm-Water Fishery (mg/l)

Temp. °C	pH												
	6.6	6.8	7.0	7.2	7.4	7.6	7.8	8.0	8.2	8.4	8.6	8.8	9.0
4	2.5	2.5	2.5	2.5	2.5	2.5	2.1	1.5	0.9	0.6	0.4	0.3	0.2
6	2.4	2.4	2.4	2.4	2.4	2.4	2.1	1.5	0.9	0.6	0.4	0.2	0.2
8	2.3	2.3	2.3	2.3	2.3	2.4	2.0	1.4	0.9	0.6	0.4	0.2	0.2
10	2.3	2.3	2.3	2.3	2.3	2.3	2.0	1.4	0.9	0.6	0.4	0.2	0.2
12	2.3	2.3	2.3	2.3	2.3	2.3	2.0	1.4	0.9	0.6	0.4	0.2	0.2
14	2.2	2.2	2.2	2.2	2.2	2.2	2.0	1.4	0.9	0.6	0.4	0.2	0.2
16	2.2	2.2	2.2	2.2	2.2	2.2	1.9	1.4	0.9	0.6	0.4	0.2	0.2
18	2.2	2.2	2.2	2.2	2.2	2.2	1.9	1.3	0.9	0.6	0.4	0.3	0.2
20	2.1	2.2	2.2	2.2	2.2	2.2	1.9	1.3	0.9	0.6	0.4	0.3	0.2
22	1.9	1.9	1.9	1.9	1.9	1.9	1.6	1.2	0.8	0.5	0.3	0.2	0.2
24	1.6	1.6	1.6	1.6	1.6	1.6	1.4	1.0	0.7	0.4	0.3	0.2	0.1
26	1.4	1.4	1.4	1.4	1.4	1.4	1.2	0.9	0.6	0.4	0.3	0.2	0.1
28	1.2	1.2	1.2	1.2	1.2	1.2	1.1	0.8	0.5	0.3	0.2	0.2	0.1
30	1.1	1.1	1.1	1.1	1.1	1.1	0.9	0.7	0.5	0.3	0.2	0.2	0.1

$$C_e = [\, C(Q_e + Q_s) - Q_s C_s \,] / Q_e$$



"…to restore and maintain the chemical, physical, and biological integrity of the Nation's waters."

[33 U.S.C. § 1251 (a)]